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ABSTRACT

This teaching guide is designed for use with three units of study (presented in separate booklets titled "The Ocean," "The Harvest," and "Using the Sea Wisely"). The multidisciplinary units contain teaching and learning resources designed to provide: students with learning experiences using a variety of thinking processes; learning experiences in science, social science, home economics, English, and art; and a balance between local and overseas focus for students bearing in mind that the focus audience is in school in both the United States and Australia. "The Ocean" is designed for lower secondary students and serves as an introduction to the ocean environment. "The Harvest" is intended primarily for lower to middle secondary levels and focuses on harvesting, fishing in traditional and industrial societies, marketing fish, and the social, cultural, and moral issues involved in the consumption of fish. "Using the Sea Wisely" is designed for upper secondary students and introduces a number of complex concepts dealing with the management and regulation of the ocean and its resources. Included in this guide are instructional strategies for the student activities in the three booklets, list of materials needed and procedures for laboratory activities, and suggestions for introducing and/or extending topics. (JN)

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HARVESTING THE OCEAN

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Teachers' Handbook

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Teachers' Handbook

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Foreword

One of the aims of the Pacific Circle Consortium is the development of educational materials with an international perspective, particularly materials that take into account the half of the earth's surface covered by the Pacific Ocean.

The Consortium works on the assumption that educational materials about other people and other cultures will be most accurate and genuine when developed jointly, by people from the country using the materials and people from the country being studied.

Harvesting the Ocean includes material from many Pacific countries and cultures. It has been developed and published as the result of co-operation between many people in a number of different countries. For their assistance and co-operation, and especially to Helen Connell, and to the Northwest Regional Educational Laboratory, Portland, Oregon, USA, we express our thanks.

David Francis
Acting Director

Members of the Pacific Circle Consortium in 1984 were:

Australia
Curriculum Development Centre, Canberra
Tasmanian Department of Education, Hobart*
Queensland Department of Education, Brisbane

Canada
Faculty of Education, University of British Columbia, Vancouver

Japan
Hiroshima University, Hiroshima
National Institute for Educational Research, Tokyo

New Zealand
Department of Education, Wellington

United States
Curriculum Research and Development Group, University of Hawaii, Honolulu
East-West Center, Honolulu
Northwest Regional Educational Laboratory, Portland, Oregon
Alaska Department of Education, Juneau

*Associate Member

Introduction

The Development of these Materials

Harvesting the Ocean was developed as part of the activities of the Pacific Circle Consortium.

The Consortium:

- is an organisation dedicated to the improvement of teaching about people and nations of the Pacific and about the Pacific Ocean itself
- was established in 1977 as an official program of the Centre for Educational Research and Innovation of the Organisation for Economic Co-operation and Development (OECD/CERI).

The purposes of the Consortium are:

- to share ideas, resources, information, materials and personnel among Pacific countries and educational institutions
- to undertake co-operative development of curriculum materials and educational support services.

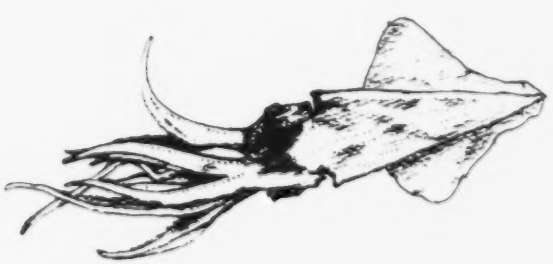
The Consortium's activities:

- relate to the Pacific region, broadly defined
- reflect interests, issues and concerns that extend beyond national boundaries
- promote internationally co-operative research and development in education
- make an innovative contribution to educational thinking and practice.

The first major undertaking of the Consortium was the development by member institutions of teaching/learning resources for students on a common theme: Wise Use of Ocean Resources. These materials were based on a common framework of aims and objectives and on the common intention of fostering constructive relationships between and among the nations of the Pacific. These were designed to produce varied resources for learning and were not predicated on a common syllabus or a unified course of study. They were designed to give emphasis to a number of substantive concepts, ideas and processes drawn mainly from three disciplinary areas:

social sciences
environmental sciences
humanities

Harvesting the Ocean draws on materials developed by Helen Connell for the Curriculum Development Centre and on *Perspectives of the Pacific: Food Resources*, developed by Susan Buel for the Northwest Regional Educational Laboratory as part of these Pacific Circle Consortium activities.



Understanding Other People

The development of these materials stems from a belief that we need to understand people of different cultures and societies. We need to understand that common human needs underlie the wealth of cultural and social traditions strikingly evident throughout the world. This remarkable diversity shows that:

- there are many possible ways of satisfying human needs;
- distinctive traditions have emerged in relation to different environments;
- as environments change, so have the ways in which people respond to them.

Focus of Materials

The materials consist of three student booklets which are for use with students aged 12-16 years. The three units, *The Ocean*, *The Harvest* and *Using the Sea Wisely*, are multidisciplinary booklets of teaching/learning resources and are designed to:

- provide students with learning experiences using a variety of thinking processes;
- provide learning experiences in science, social science, home economics, English and art;
- link together types of learning experiences and activities often separated into different 'subject areas';
- provide a balance between local and overseas focus for students bearing in mind that the focus audience is in schools in both the U.S.A. and Australia;
- draw where possible on direct experiences of students and relate to interests common to students of the 12-16 age group;
- involve practical school based activities, and suggest out of school activities;
- include oral, visual and written activities;
- include independent as well as group learning experiences; and
- involve students in defining and undertaking some independent research activities.

Themes of Sections

The content of the materials is focused specifically on the **Pacific Ocean** and its surrounding countries.

The basic themes of each unit are:

1. **The Ocean**
   - The structure of the ocean environment provides a range of habitats to which marine plants and animals have adapted.
   - The ocean is a significant and common element in the experience of people from cultures of different parts of the Pacific region.
   - The growth of human understanding of ocean environments has been closely linked to technological developments.

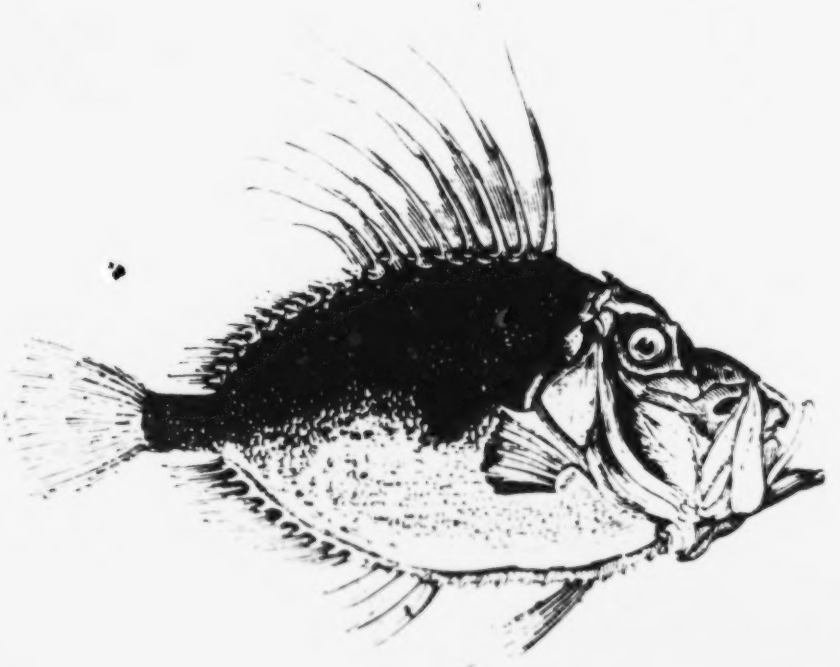
2. **The Harvest**
   - Harvesting the ocean is a hunting activity which requires a considerable level of organisation, skill and risk.
   - Available technology and socio-economic organisation have shaped different patterns of harvesting ocean food resources.
   - The marine environment has influenced the cultures and livelihoods of many Pacific peoples.
   - The development and change in processing methods for ocean food resources have brought important changes in patterns of harvesting and marketing ocean food resources.
   - Cultural factors are important in the uses made of marine food resources.

3. **Using the Sea Wisely**
   - Wise use of ocean food resources depends on understanding both the natural and human environments of the Pacific Ocean. Ecological and social/political factors are equally important and inter-related.
   - Good management and regulation of ocean resources is essential to the continuing productivity of the ocean.
   - It is the shared responsibility and concern of all of us to make the wisest possible use of both old and new resources.

Focus on Skills

It is the aim of these materials to help the student to develop several basic learning skills. These include:

— map work and atlas skills
— drawing to scale
— building vocabulary
— learning to group and categorise
— relating concepts to models and processes
— visual perception skills; learning to recognise and employ different types of visual representation
— individual and group research skills
— classroom presentation skills
— learning to assess the reliability of different documentary sources
— learning to integrate materials from different but related disciplines



Book 1 The Ocean

Book I is designed for lower secondary students. It is an interdisciplinary unit that does not aim to take the place of general science courses but to complement them.

Its primary function in the unit-as-a-whole is to provide students with simple introduction to the ocean environment, one that will give them a basic understanding of the physical factors underlying the issues raised in Books 2 and 3.

1.0 Introducing the Pacific Ocean

1.1 What Does the Ocean Mean to You?

As an introductory lesson to this booklet teachers may like to try a 'sensitisation' approach to the subject.

You might be able to arrange for students to listen to some music about the sea — such as Debussy's 'La Mer' or Britten's Sea Interludes in 'Peter Grimes'. You may prefer to record, possibly with the students, the sounds of the sea and replay them in the classroom as a prelude to 'brainstorming' impressions of the sea.

Ask students to write down words or phrases related to the sea that come to mind as they listen to the music or sea-sound tapes.

You may wish to follow this up by directing students to poetry anthologies among their own texts or in libraries. Ask them to bring into class a poem about the sea and to add to their earlier list those words and phrases from the poem that they find most expressive.

After hearing responses, the teacher could list some of them on the board. It would be interesting for the students to identify the categories their words fall into, such as:

1. Words that paint a picture of the sea, such as open, vast, huge, blue, waves, spray, foam, dunes.
2. Words that describe a feeling about the sea, such as lonely, indifferent, cruel, powerful, raging, peaceful, beautiful.
3. Words that name creatures of the sea, such as sharks, whales, fish, seagulls.
4. Words that describe how people use the sea, such as fishing, sunbathing, swimming, surfing.

The discussion could then turn to why we have the responses we do toward the sea. The teacher can lead the students to understand that our attitudes toward the sea are formed by our experiences. Thus a fisherman values the sea as his source of livelihood. A person may find peace and renewal in a quiet walk beside the sea. Someone who enjoys observing the animal and plant life along the coast may value it in another way. Some experiences in regard to the sea seem common to many people. For example, most of us are fascinated by waves breaking. It might be interesting for the class to speculate why.

Next the discussion might turn to how people's attitudes toward the sea have been formed in the past. The teacher could ask the students to imagine how a person must have felt aboard a small sailing vessel such as the *Endeavour* or the *Mayflower*, when it took months to cross a strange ocean, completely at the mercy of the elements, totally cut off from all communication with land and loved ones. It is easy to understand why the sea seemed a lonely and alien place. And when we think of the number of ships lost in storms at sea or wrecked upon strange coasts, it helps to explain why people saw the sea as an enemy that was frightening, cruel, overwhelming, or coldly indifferent.

The teacher may want to ask the students to consider next whether a person aboard a luxury liner crossing the Atlantic has some of the same feelings today. Modern technology and communication have changed the situation greatly, but if a person does not still feel some awe of the sea we would probably think that person either insensitive or foolish. This is because no matter what powers human beings acquire, they cannot have mastery over the sea. Many writers, from romantic poets to twentieth century environmentalists, have told us that we not only cannot be the masters of nature, but that we should not.

Pendleton H. Nixon, *People and the Sea: The Relationship Between People and the Sea*, Coastal Resources Center, University of Rhode Island, Marine Bulletin Number 28, MEMS 000550.

Finally, if discussion is lively, it can be worthwhile to round off the introductory exercises with a **short essay** on students' individual experience of the ocean and the ways in which it has shaped their perception, not only of the ocean but of life in general.

The responses of students will obviously vary a great deal according to the location of the school and its students. For some, their only knowledge of the ocean may have come to them from the media and this in itself can be an interesting point of discussion. What can we learn from second-hand experience? How does it compare with the real thing?

Not just any ocean — the Pacific Ocean

Perhaps the best introduction at this point is a brief 'brainstorming' session using a blackboard. What do we know about the Pacific Ocean? What are the first words/images that come into our head when we hear the words?

Fragments of geographical, historical, experiential and literary knowledge can be combined to present a mass or undifferentiated word picture. Teachers can take their cues from what comes out of this to lead into the rest of this section.

1.2 Countries of the Pacific

1.3 Islands of the Pacific

These are brief sections designed to **orientate** students to the area of study and **familiarise** them with the name and location of the countries and islands in the Pacific region.

Student Activity

The familiarisation exercises are provided in the sections, 'Countries of the Pacific' and 'Islands of the Pacific'. Both are simple word games.

Students can match up and unscramble the names individually or in groups. As a group activity this could be placed on a competitive basis and a time limit set. (Answers are provided here for teachers' reference.)

After the word games have been concluded, students can be asked to plot **location** on a blank map. This can be done roughly, i.e. giving approximate location, or accurately, using grid co-ordinates and plotting longitude and latitude.

To save time teachers may prefer to distribute blank maps of the Pacific, with or without grids.

Follow-up activities

Use globe and wall maps to stimulate student discussion on the variety of climates and cultures in the Pacific area. Point out the equator and other special features. Elicit student hypotheses about differences in kinds of sea life and use of the sea (food, energy, shipping, etc.) depending on geographic location.

To repeat, this is basically an orientation exercise. You would not want to spend much time on countries and cultures at this stage. This is the province of Book 2.

Countries of the Pacific Rim*

Antarctica
Australia
Canada
Chile
China
Colombia
Costa Rica
Ecuador
El Salvador
Guatemala
Honduras
Hong Kong
Indonesia
Japan
Mexico
New Zealand
Nicaragua
North Korea
Panama
Papua New Guinea
Peru
Philippines
South Korea
U.S.A. (United States of America — also known as America)
U.S.S.R. (Union of Soviet Socialist Republics — also known as Russia)

*Because of changing political status and of differences in interpretation of international law, there are good arguments for inclusions, alterations, deletions to and redefinitions of the listed countries and islands. These lists are provided as a guide only.

Islands of the Pacific Ocean*

American Samoa	unincorporated U.S.A. territory
Caroline Islands	United Nations Trust Territory, administered by U.S.A.
Cook Islands	self governing in association with New Zealand
Easter Island	dependency of Chile
Fiji	
Galapagos Islands	Province of Ecuador
Guam	unincorporated U.S.A. territory
Hawaii	State of U.S.A.
Kiribati (pronounced Kiribas)	independent since 1979, formerly British colony of Gilbert Islands
Lord Howe Island	part of State of New South Wales, Australia
Marquesas Islands	part of French Polynesia — overseas territory of France
Marshall Islands	United Nations Trust Territory, administered by U.S.A.
Nauru	
New Caledonia	overseas territory of France
Niue	self governing in association with New Zealand
Norfolk Island	territory of Australia
Northern Mariana Islands	United Nations Trust Territory, administered by U.S.A.
Pitcairn Islands	dependency of Britain
Solomon Islands	independent since 1978, formerly British Solomon Islands Protectorate
Tahiti	part of French Polynesia — an overseas territory of France
Taiwan	
Tokelau	dependency of New Zealand
Tonga	independent since 1970
Tuvalu	independent since 1978, formerly British colony of Ellice Islands
Vanuatu	independent since 1980, formerly a condominium jointly administered by Britain and France
Western Samoa	independent since 1962, formerly United Nations Trust Territory

For detailed information about the Islands of the Pacific Ocean: See *Pacific Islands Yearbook*, Pacific Publications, Sydney.

2.0 Creatures of the Ocean

2.1 Plankton: The Drifting Population
- 2.1.1 Plant plankton
- 2.1.2 Animal plankton

2.2 Nekton: The Active Swimmers
- 2.2.1 Habitat
- 2.2.2 Structure

2.3 Benthos: The Bottom Dwellers
- 2.3.1 Invertebrates: The 'Creepers' and 'Crawlers'
- 2.3.2 Vertebrates: Benthic Fish

2.4 Seabirds

The information in this section is relatively academic and introduces a number of scientific terms and processes from biology and zoology.

The section attempts to minimise the number of scientific terms used.

To bring the section to life, teachers may wish to focus on drawing illustrations and making models. In Section 2.4, seabirds are used as examples of how objective, expressive and stylised techniques can be used in illustrations. These activities stimulate the students' observational skills by focussing on details of shape, size, colour, and design. By hanging ocean plants and animals from the ceiling, the light fixtures and walls, students can get a feeling of the variety and richness of forms of sea life.

Focus: Observation and Differentiation Skills

Student Activity 'Let's make our classroom into the ocean.'

Suggested Procedures

Working singly or in small groups the students can look through reference books until they find an ocean life-form they would like to make. Have a sign-up sheet to avoid an over-population of sharks! Students may wish to work together to produce a school of fish.

Students can begin by drawing an outline of their chosen life-form as large as feasible on a sheet of paper. Be sure students have a reference book in front of them as they work to obtain as much accuracy as possible.

Clip a sheet of paper behind the drawing so that when the outline of the life-form is cut out, two identical shapes are obtained. The features can then be filled in and coloured on both papers to form right and left sides of the animal. Encourage students to include all details. If this is a fish, where are the fins located? The gills? Did you remember to draw the scales? What specific details does your life-form have that makes it different from the others?

Staple the two sides of the life-form together in several places around the margin. The animal can then be stuffed with crumpled paper and the last opening stapled shut.

Be sure to put the name of the animal on both sides so that others will be able to identify it too. It would also be nice to include the name of the 'scientist' who drew it.

Run twine, or nylon monofilament (nearly invisible) through two places in the top of the animal and hang it from the ceiling or along the walls.*

You may wish to structure this activity more and concentrate on placing the students' models in a mock 'habitat'. Nominate a classroom wall or other free space as 'the ocean'. **Locate and label specific habitats of the ocean.** Ask students to 'place' accurately their chosen life-form in its natural habitat; for example, to attach a benthic fish to the bottom region, and so on. In this way students can build up an overall picture.

In this model-making exercise, **fish** are likely to prove the most popular choice. Another activity to do with fish is Japanese Fish Printing. This activity could be undertaken as a joint exercise with the school Art Department.

The students' book provides some information on Japanese Fish Printing (Gyotaku), namely 'History', and 'Materials'. For further details of the process of making a print and how to use the materials, students are directed to ask their teacher.

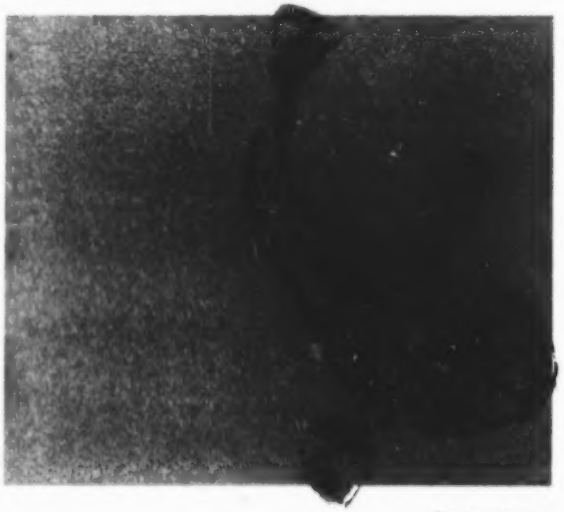
The teacher reference material set out below is from *Gyotaku — Japanese Fish Printing*, Division of Agricultural Sciences, University of California, Leaflet no. 2548.

Gyotaku

History

Gyotaku means fish rubbing (gyo = fish, taku = rubbing). Fish printing originated in Japan or China in the early 1800s. (Plants have been printed in Europe since the 1400s.) In Japan, *gyotaku* is practiced by sportsmen to preserve records of their catches. (A fish print never lies, but fishermen do!) In the United States, it has been practiced as an art form for about 25 years; the late Mrs. Janet Canning was an America pioneer in *gyotaku*. Fish printing has become especially popular in the U.S. in the last 10 years.

Practising the art of *gyotaku* (pronounce gyo like your) is a good way to gain appreciation of the beauty and great variety of marine organisms. You can also use this technique for making prints of shells, rocks flowers, and other objects of nature.



Staghorn Sculpin

*Adapted from *Perspectives of the Pacific — Food Resources*, Northwest Regional Educational Laboratory, Oregon.

Materials

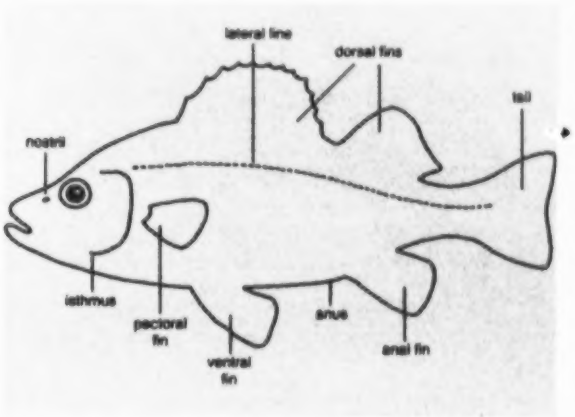
1. Obtain a *very fresh fish*. If you catch a fish yourself, keep it cold and try to print it within 24 hours. Otherwise freeze the fish; it will print well when thawed. Be sure that the fish's fins or body are not severely damaged. You can gut the fish if you want to and then fill the body cavity with paper towels.

If you buy the fish at a market, select one with bright red gills, clear eyes, and a fresh smell. Look for fish with large rough scales, spines, reasonable size (6 to 18 inches), and a flat shape. Such fish as rockfish, flounders, bass, dories and perch are good beginning choices.

2. *Thick water-based inks* are best for beginning. Traditionally, the Japanese have always ground sticks of carbon-based sumi ink. Water-based linoleum block printing ink is another excellent ink, and it is easy to use. Black is a good colour to work with, but you may want to try such other dark colors as brown, red, green, or blue.
3. You will need *several brushes*, ranging from size 00 for painting in the eyes to one inch for applying ink to the fish. The larger brushes should be fairly stiff because you want to get a very thin coat of the thick block printing ink on the fish.
4. *Moisture-tolerant paper* is used for printing. For the beginner, newsprint and sumi-e painting and sketch paper are recommended. Handmade oriental papers ('rice' paper) will give the best results, as you gain experience.
5. You will also need:
   newspaper
   plastic modelling clay
   straight pins.

Fish Anatomy

To guarantee good printing results it is useful to understand fish anatomy.



1. *Fins:* Most fish have at least one dorsal fin, a tail fin, an anal fin, a pair of ventral fins, and a pair of pectoral fins. Often the first dorsal fin will have hard, sharp spines, while the other fins will have soft, flexible fin rays. The fin spines and rays are connected by a thin fleshy material that readily collects excess mucus and ink that should be wiped off. Some fish (trout and salmon) have a small fleshy adipose fin that is difficult (but important) to print.
2. *Scales:* Fish scales vary in structure and reproduction quality. Sharks have sandpaper-like scales that are really modified teeth; they are difficult to print and require an extra thick coating of ink. Trout, salmon, and smelt have delicate 'deciduous' scales that are difficult to print; sometimes removing all scales and printing the scale pocket that the scale lies in is best. Many fish have hard, rough scales (i.e. perch, rockfish); their scales will turn out well in prints and these fish are easiest to work with.
3. *Lateral line:* Most fish have at least one lateral line. The lateral line is a series of small organs used by the fish to sense turbulence and pressure changes. If you print correctly, the lateral line will be very striking in your prints.
4. *Spines:* Many fish have spines around the head. These spines can be poked through the paper. If properly printed, most of the fish's spines will reproduce beautifully.
5. *Mucus:* Fish secrete mucus from their bodies to protect themselves from parasites and disease and to help them 'slip' through the water easily. The mucus tends to make a fish print less clear and dark in color. For this reason it is important to remove as much mucus as possible by washing the fish thoroughly. Mucus tends to collect on the fins, near the anus, gill cover, isthmus, and nostrils, and under the pectoral fins.
6. *Body form:* Fishes' bodies vary greatly in shape. A flat flounder lies on the ocean bottom, while a round, bullet-shaped tuna needs to swim efficiently to capture prey. Generally, the flatter the fish, the easier it is to print.

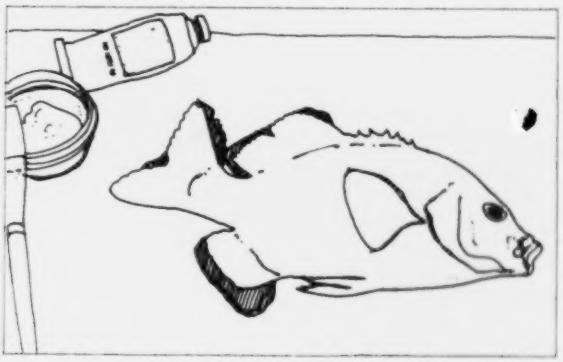
Methods

1. Clean the outside of the fish with soap and water to remove dirt and mucus. Dry it well. Be careful not to damage the fins or to dislodge too many scales. You should also plug the anus of the fish with a small piece of paper to insure that the fish won't 'leak' onto your printing paper.
2. Place the fish on a newspaper-covered table. Spread the fins on plastic modelling clay. If necessary, pin the fins to the clay to keep them in position. These first three steps: selecting, cleaning, and setting up of the fish, are important. Take your time on these steps and your prints will turn out well.
3. Brush a thin coat of ink on the fish, using a half inch to one inch brush. If the ink is too thick (especially in hot weather), you may want to thin it slightly. However, thin, watery inks don't work well. When first applying the ink, stroke your brush from head to tail. Leave the eye blank and paint it in later with a small brush. After the entire fish is covered with ink, brush from tail to head. By reversing the direction of your brushing, you catch the ink under the edges of the scales and spines and improve your print.
4. Place the moisture-tolerant paper carefully over the top of the fish. Press the paper firmly with your fingers over the entire inked fish. Be careful not to wrinkle or move the paper excessively. (With round-bodied fish you may have to move the paper somewhat to avoid wrinkles.) Excessive paper movement can result in 'double prints'. When you finish rubbing the fish, gently remove the paper. Then, study your

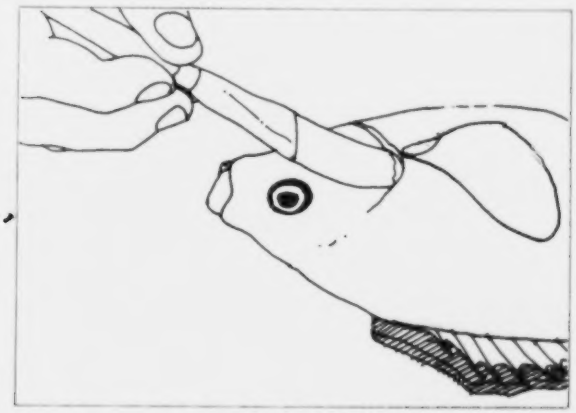
results for mistakes, re-ink the fish, and do another print. A good fresh fish can yield three to ten good prints.

5. With a small brush paint in the eye.

6. Wash off the fish and prepare it for dinner if non-toxic inks have been used.

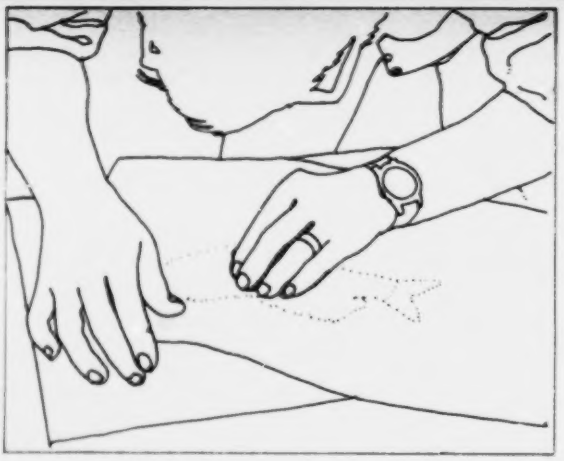


STEPS 1, 2. A fish is properly prepared for printing. Note the clay supporting the fins.



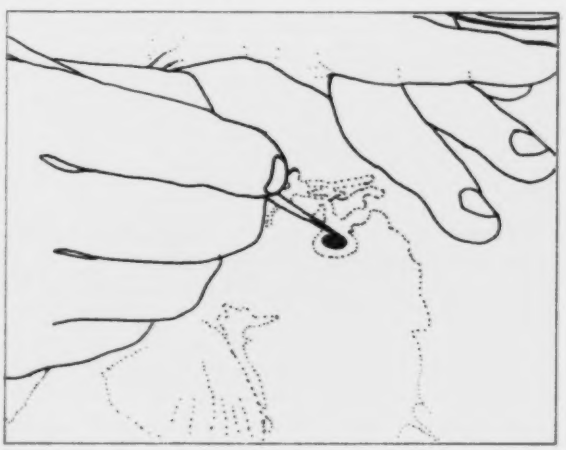
STEP 3. A thin coat of ink is brushed on the fish from head to tail. For a clear print, final brush strokes should be made from the tail toward the head.

STEP 4A. Paper is placed carefully over the inked fish.



STEP 4B. The entire fish is then rubbed with fingers to transfer the ink to the paper. Watch out for sharp spines. They can be painful.

STEP 4C. The print is carefully removed from the fish.



STEP 5. The eye is then painted in by hand.

2.5 The Flow of Food.
2.5.1 The Food Chain
2.5.2 The Food Web
2.5.3 The Food Pyramid

This is a complex section which teachers will need to play a central role in introducing, clarifying and revising. It will demand a lot of direct teaching and explanatory board-work.

A good student activity is to allocate a particular fish to each student, preferably a popular species for ease of research. Ask the student to draw up a representation of the food chain of that species. A similar exercise can be carried out for the food pyramid of any particular oceanic life-form.

This is a good research exercise.

Students should be instructed to keep a record of research material used and to accompany their final diagrams with a list of sources. For example,

Encyclopedia Britannica, Volume 7, Page 921, 'The main diet of tuna is . . . '

Focus: Clarifying Concepts and Processes and Developing Research Skills

Student Activity

• Survive as an animal in a make-believe food chain by getting enough to eat while avoiding being eaten.

Feeding relationships are often difficult to observe. In this activity, students gain some understanding of these relationships by assuming the roles of animals, playing tag, and simulating feeding relationships. Popcorn is spread over a lawn area. The kernels of popcorn represent plants (or detritus formed from plant materials) which are food sources for the plant eaters. Some students play worms (often plant eaters), some play fish (which eat worms), and some play people (who eat fish). The object of the game is for each animal to get something to eat without being eaten before the 'day' (five minutes) is over. In nature, the population of plants and animals are usually large enough to ensure continuation of the species if some are lost. In this game, populations (plants, worms, fish and people) are so small, that the survival of even one of each kind will be considered an indication of a 'balanced', ongoing community. You can repeat this game many times during one activity session. With each, repeatedly encourage students to change rules of behaviour and numbers of each kind of animal until a 'balance' is achieved in your plant-work-fish-people **food chain**.

3.0 Exploring the Surface of the Ocean

3.1 Staying Afloat
3.1.1 Why a Steel Ship Floats

Focus: Vocabulary exercises
Experimental skills

Teachers may like to begin this section with a further sensitising lesson, concentrating on sensations and the imagination, and the recollection of sensations.

How does it feel to swim? To float? To sink? To sit in a dinghy? To cruise in a yacht? To speed along in a power boat? Ask students to list all the varied sensations they can imagine relating to man in or on the water, e.g. bobbing, drifting, rocking.

Teachers may wish to give practical demonstrations and conduct experiments in the classroom. Alternatively, ask general science or physics students to prepare in advance a demonstration of the relative principles.

Student Activity

Measuring density.

You will need

- a set of density cubes of various materials e.g. wood, aluminium, zinc, lead
- a balance.

By measuring the mass of each you can compare the 'amount of mass packed into a definite volume' (one cubic centimetre) for different materials. That is, you can compare densities.

Using the balance, find the mass of each of the one centimetre cubes, to the nearest 0.1 gram.

Substance	Mass	Volume (cm^3)	Density (g/cm^3)

Suggested classroom visitor: local boatbuilder to discuss the underlying principles of the craft.

3.1.2 Exploring the Pacific Ocean: The Early Navigators

This section has been included to give an historic and human dimension to the study of the Pacific Ocean.

Focus: History: The Evolution of Sea Transport: Human Skills Interacting with Nature

Student Activity

1. Teachers with course time available may wish to direct students into more detailed historical research — also into extension work, e.g. the development of the compass and navigation.
2. Ask students to imagine that they are on board an historic ship that is navigating the Pacific. They are to write up a diary of their experiences over seven days — conditions experienced, plant and animal life observed, etc.

3.1.3 Language from the Sea

This section can be used to build vocabulary and awareness of the origins of many common expressions, as well as to emphasise the difference between literal and figurative language.

Some nautical terms we use literally, adhering to the nautical definition (bait, bail, aboard, astern). Some we use figuratively, as a way of describing a

completely non-nautical situation (above-board, backwater, derelict, hard up).

Focus: Vocabulary & English Skills

Student Activity

1. Direct students to list the terms in the booklet under two headings, literal and figurative. Ask them to list as many additional terms in each category as they can think of.
2. Have each student choose ten words or expressions from the sea that we use figuratively. For each one, write a sentence using it appropriately.
3. Many of these expressions are picturesque and would thus lend themselves to pantomime. Divide the class into five or six groups. Each group choose one or two expressions to act out as a group charade or impromptu pantomime. Both the literal and figurative meanings could be shown if desired. When everybody is ready, other groups can watch and guess which expression is being shown, as each group performs.

3.2 Waves, Currents and Tides

- 3.2.1 Waves
- 3.2.2 Beach Erosion
- 3.2.3 Currents
- 3.2.4 Tides
- 3.2.5 The Intertidal Zone

Focus: Experimental Skills
Map Work
Field Work and Observation Skills

Student Activity

1. Invite senior students in the school who are experienced surfers to come into the classroom to discuss types of waves and the surfer's relationship with waves.
2. Where possible take students on an excursion to observe the effects of beach erosion. Ask them to prepare reports, complete with drawings and/or photographs. They will need to adequately prepare for such an excursion by first researching local climatic conditions.
3. Organise students to investigate the effects of surface currents on particular countries. Many will choose to make a special study of their own country.
4. Co-operate with school science teachers to mount simple experiments demonstrating the effect of certain forces on ocean currents. There is a well known set of experiments, which most science teachers will be familiar with, that demonstrates the effect on currents of the sun's heat, the spinning of the earth on its axis, and winds.
5. Suggest to students that the next time they go to the beach they plant a stick at the water's edge and see what happens to it over a period of time.
6. Students can collect a tide chart for the nearest coast area, choose a one month period and plot low and high tides for this period on the graph. Each student should choose a different month from other students in the class — they can then combine results. Direct students to mark in the quarters of the moon. They should then study their graph and answer the following questions:
   Are the high and low tide levels for each day the same? What do you notice over the month about overall **tide range**?
7. As an extra activity students can research how tides are measured.
   They can find out about tidal ranges (spring, neap or average) for different places on the coastline. These can be plotted on a map to see what pattern emerges.
8. Consider a visit to a rocky shoreline if one is accessible. Plan to visit when the tide is at its lowest ebb. Photograph or otherwise record specimens. The next page contains an individual excursion sheet for students.
   Use class-room follow-up to
   (a) create models of individual specimens,
   (b) reconstruct a miniature model of a section of the rocky shoreline environment, and
   (c) discuss unexpected variations and local features.

You may wish to co-operate with general science teachers on such an excursion and plan an integrated studies program, utilising laboratory equipment (microscope, slides, etc.) in the preparation and follow-up.

Studying the Intertidal (Littoral) Zone — Making an Excursion to the Seashore

If you live near the ocean, you might be able to arrange an excursion to the coast **to make a study of plants and animals in a marine habitat.** Habitats you might choose from are: **the intertidal zone, a rocky headland*, a sandy beach** or **an estuarine area.** Questions to focus on in your excursion are:

- What **sorts of conditions** do intertidal plants and animals live in? How long are they wet/dry between tides? This will vary as they live closer to high or low tide level. Do they move?
- What **sorts of adaptations** have intertidal plants and animals developed to cope with the conditions in which they live? (e.g. move out of harsh sun to shelter between tides, hard shell to stop drying out . . .)

Make sure you begin your study on a falling tide, and keep a watch on the tide once it begins to come in again. You will want to be there at low tide. Remember there is about six hours between high and low tide. Make sure your excursion is not on a very windy or wet day. Take a notebook and a sketch book with you, and a number of pencils (they will still write if your paper gets wet; ball point pens won't write on wet paper).

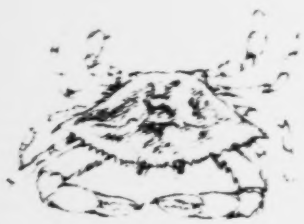
(1) Make a general sketch of the intertidal zone you are visiting, noting high and low tide positions. Mark in the positions of the individual plants and animals you sketch. Can you observe any patterns or zones in which different intertidal plants and animals live?

(2) Make a quick sketch of each plant or animal, write a short description of it, and its location, (especially how far it is away from high or low tide mark) and briefly note the adaptations of the plant/animal to its environment.

You might also, or instead, take photographs of the plants and animals. Try to avoid taking plants and animals away from their natural environment — this is one way environments are destroyed. Learn to appreciate nature in its natural location — this will help you become more observant, because you will have to remember how things were. Also, they will be there when you come back some other time!

In your classroom, you could make some paintings, murals or dioramas of the different ocean habitats you have observed.

* Avoid rocky headlands exposed to ocean swells. Choose sheltered situations or keep a lookout posted. Make sure you can retreat quickly to a safe place. Intertidal rock platforms can be fascinating but they can also be dangerous.



3.3 What Makes Up Sea Water?

Focus: Experimental Skills

Student Activity

Telling Sea and Fresh Water Apart

Here are three ways you can tell fresh water from sea water.

You will need a small supply of sea water and of fresh water. If you don't have access to sea water and you wish to make up some in order to study it, simply add the right quantities of major salts to fresh water. Do not bother with minor salts or trace elements. For example, to make up a litre of sea water, you should add 23.0 grams of sodium chloride, 5.0 grams of magnesium chloride, etc. (see table on page 53 of Book I).

Measure 10 cc of sea water into each of three beakers. Then measure 10 cc of fresh water into each of the three beakers. (Use six identical beakers if possible.) Make three groups of two beakers each, with one sea water and one fresh water in each group. Don't label any of the beakers. Get a friend to move the beakers around so you don't know which is which.

Testing

1. With the first set of two beakers, tell the two apart by **tasting**. What difference do you find? Label the beakers and keep the water for comparing with later experiments.
2. With the second set of two beakers, tell the two apart by **evaporation**. Over a bunsen burner, evaporate the water in the two beakers. Make sure when you get to near the bottom that you turn the flame down so that you don't break the beaker! What differences do you find? Keep any sediments from the two beakers. (If possible when you are evaporating the two beakers of water, use a distilling apparatus, and catch the steam in another container. Let the steam condense, and test the water by tasting.)
3. With the third set of two beakers, tell the two apart by **freezing**. Put water from each beaker into two plastic containers and place in a freezer. Check at intervals. Which one begins to freeze over first on the surface? When about a quarter to a half of the liquids are frozen, remove them from the freezer and examine the solids and liquids.
   What do you notice about the remaining liquids? Compare these with the water in the first set of beakers.

Answers to questions on page 53 of Book I

1. There is less land in the southern hemisphere, so there is less runoff to dilute the ocean.
2. There is more precipitation rain in the tropics and in the higher latitudes.
3. There is higher evaporation at sea to begin with, plus the land close by is very dry, so no large rivers drain into the sea.

4.0 Exploring the Depths of the Ocean

4.1 The Shape of the Ocean Floor
- 4.1.1 Continental Margin — Under the Coastal Ocean Waters
- 4.1.2 Deep Ocean Floor — Under the Open Ocean Waters

4.2 Deep Water
- 4.2.1 Light
- 4.2.2 Temperature
- 4.2.3 Salinity
- 4.2.4 Pressure

4.3 Exploring the Depths
- 4.3.1 Measuring the Depth of the Ocean

4.4 A City Beneath the Sea?

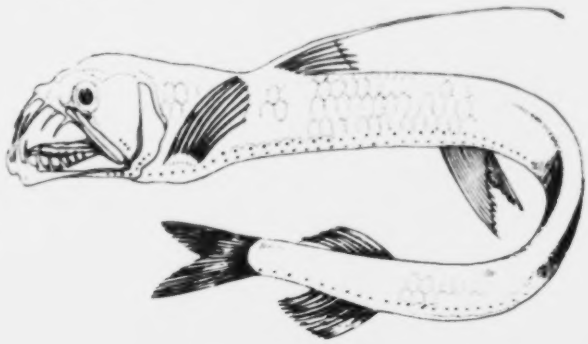
This section is one in which there is great scope for model-building. Enlist, where possible, the co-operation of general science and geology teachers who, as well as talking to groups, may be able to provide interesting scale and relief models, photographs, etc.

There is also great scope here for imaginative and creative writing exercises — exploring the depths of the sea, constructing underwater cities and so on.

Focus: Model Building
Drawing to Scale
Creative Writing

Student Activity

1. You may wish to set aside one whole day or half-day and create an 'underwater environment' in the class room, using large wall charts, paper models of deep-sea creatures and lighting effects.
2. Ask students to see what they can find out about underwater photography and what sorts of films are used.
3. Research project: What are the various ways in which humans are able to breathe underwater?
4. Suggest to students that they invite underwater specialists to visit the school and/or make available supplementary material.
   Possible visitors include:
   — fishermen divers, e.g. abalone divers
   — police rescue squad
   — recreational divers, e.g. scuba diving club members
   — salvage and construction work divers
5. Complete this section with the imaginative exercise set out at the end of Book I, 'A City Beneath the Sea?'



Revision

By the end of each section you may wish to play a revision game. The one below is designed for Section 2.0. Revision 'scramble' can easily be devised by the teacher for all other sections.

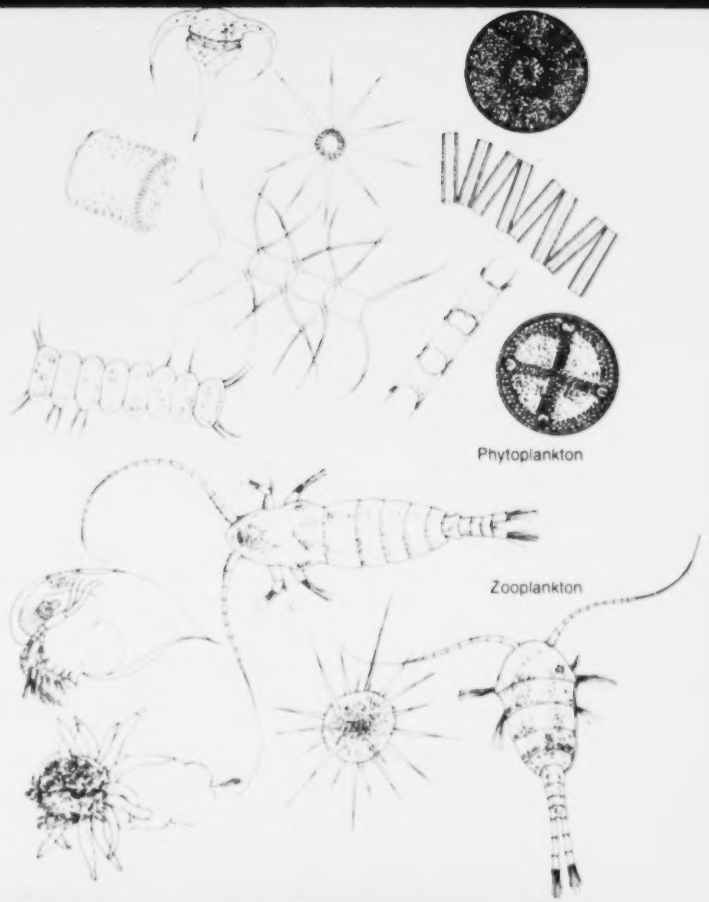
Unscramble

Can you unscramble these words, and match them up with their meanings?

1	pyklonthantop	(a) a marine bird which spends a lot of time at sea
2	alozonktonp	(b) coastal zone between the tides
3	gala	(c) a group of fish
4	alhews	(d) a type of anadromous fish
5	plek	(e) animals and plants that live on the ocean floor
6	ochlos	(f) plants that float in the sea
7	noslam	(g) large ocean mammals
8	galpice	(h) soft bodied type of animal which includes squid and oysters
9	tailltor	(i) animals that float in the sea
10	trarvesbete	(j) surface swimming fish
11	shotenb	(k) animals with backbones e.g. fish, whales
12	bastalors	(l) a type of floating seaweed which caused much trouble to pirates
13	lloscum	(m) seaweed
14	sgumsaras	(n) type of seaweed found near the sea shores

Answers

phytoplankton, zooplankton, alga, whales, kelp, school, salmon, pelagic, littoral, vertebrates, benthos, albatross, mollusc, sargassum.



Book 2 The Harvest

Book 2 is intended primarily for lower to middle secondary levels. Teachers will note that Book 2 does not deal with questions relating to the conservation, management and international regulation of resources. These are covered in Book 3, *Using the Sea Wisely*.

Part I Harvesting

The following section is reproduced from the opening pages of Book 2 and sets out the **conceptual framework** for this unit of study.

Harvesting the ocean is a hunting activity. For thousands of years many societies have relied on the sea for their **main food source**.

Today all the peoples of the Pacific Circle make use of the plants and animals of the ocean as food sources. All are involved in some way with one of the oldest hunting activities, although the means used differ greatly from one culture to another.

Part I of this booklet looks at fishing in three **traditional societies**:

— the Puget Sound Indians of North America
— the coastal Aborigines of Australia
— The Solomon Islanders of the Western Pacific

By traditional societies we mean those which are organised on the basis of **long established** and generally accepted customs and methods of procedure.

If we look at the history of traditional societies we find that there usually has been a very **slow rate of change**. The most common reason for a slow rate of change is **geographic isolation**.

Part I also looks at fishing in three **industrialised** societies:

— Japan
— Australia
— United States of America

By industrial societies we mean societies organised on the basis of systematic labour for the production of commercial goods. To survive, a person needs only food and basic shelter. Any goods produced over and above survival needs and that are used in trading and exchange, we call commercial goods. Modern industry is based upon this kind of trade.

In looking at the differences between fishing in traditional and commercial societies we will be focusing on the following questions.

1. Habitat

What are the different **marine environments** that people live in?

How do these affect the kind of **society** they live in, in particular the **physical organisation** of that society? For example, do they live in large or small villages or towns?

How does their marine environment affect the kind of **work** that people do? For example, are they fishermen or ship-builders? If they are fishermen, what kind of fishermen?

What kinds of **marine life** are available?

What kinds of **raw materials** are available for making (a) boats and (b) hunting implements?

What kinds of **skills** are involved in hunting marine life?

What kinds of **risk** are involved?

2. Society

How has the kind of society that fishermen live in influenced the ways in which they hunt? For example, what influence does their **religion** have on their attitudes to (a) the ocean and (b) the ways in which they hunt?

Do the fishermen hunt as a **community** and share their catch? Do they hunt as individuals and trade their catch for other items?

What is the **technology*** available to the society?

What kinds of hunting implements and aids are used?

What kinds of boats are used? Are they heavily or lightly equipped?

What kinds of skills are involved in making them?

3. Economy

Do the fishermen work within a **subsistence or a commercial** economy?

What are the common items of trade and exchange? What forms of money, if any, are in use?

Do the fishermen hunt only for **subsistence**, that is for their own survival needs, or to sell their fish **commercially**, in exchange for money?

When a fish is sold is it bought directly by the consumer or is it handled by several other people first?

There are various kinds of middlemen: transport operators; food processors; fish marketers; fish-shop owners; restaurateurs.

1.0 Fishing in Traditional Societies

1.1 Salmon Fishing in the Puget Sound Area Long Ago

1.1.1 Fishing Legend

1.1.2 Indian Fishing Technology

This section looks at salmon fishing in the Puget Sound as carried out by the Salish Indians. The emphasis is on the complex and innovative skills of the Indians, the richness of their environment, and the ways in which they developed technologies uniquely **adapted to their environment**.

Focus: Concepts of
- **Traditional Society**
- **Subsistence**
- **Pre-industrial Technology**
- **Adaptation**

*technology — from the Greek 'the science of the practical arts'

Student Activity

1. Have students read and discuss the legend, 'The Maiden of Deception Pass' (Section 1.1.2).
   - What does the legend tell us about the culture of the Salish Indians. Their **assumptions about nature?** Their values and priorities?
   - How does the legend compare with sea legends from other sea-oriented cultures? (This could be the basis of a research project into other traditional societies — for example, the sea legends of the Australian Aborigines or the ancient Greeks.)
   - What is a myth? What is a legend? What is the **function of myths and legends** in traditional societies? Why are aspects of nature personified?
   - What are the myths and legends of our own culture?
   - Ask students to write their own legends to explain some local phenomenon of nature — for example, Ayers Rock, the Grand Canyon, the Nullarbor Plain, Niagara Falls.
2. Ask students to nominate the Indian fishing technique, from among those illustrated, that interests them most. Students can explain their choice in written form and present a report to the rest of the class.
3. How many of these techniques could be applied in the local environment? Where? What modifications would be necessary? Were any of these techniques used by local indigenous peoples? If not, why not? What methods were used instead and why?

1.2 Aboriginal Fishing Culture

This section focuses on the North Eastern Arnhem Land Aborigines of Australia. Following from the introduction to myth and legend in Section 1.1, this section looks at the religious significance of the sea for the Aborigines and the concept of **totemism**. It also looks at the ways in which the Aborigines practice conservation of resources.

Focus: Concepts of
- **— Totemism**
- **— Conservation of Resources**

Student Activity

1. The focus of student activity should be a **comparison** of the Puget Sound Indians and the North Sea Arnhem Landers, in particular the inter-relationship between fishing (subsistence economy) and religion and social custom. Compared to modern industrialised societies, both cultures exhibit a highly **integrated** way of life.

1.3 The Fish Hook

1.4 Changing Traditions of the Solomon Islands

This section looks at the people of the Solomon Islands and

(a) their adaptation to a specific environment, i.e. coral reefs, and

(b) the ways in which a traditional society responds to external change and the **impact of Western culture**.

Focus: Concepts of
- **— Change**
- **— Adaptation**
- **— Westernisation**

Student Activity

1. Here again, the focus of student work and discussion should be **comparative**.

   How do different physical environments result in different kinds of fishing culture? For example, would the Solomon Islanders travel more by boat than the Puget Sound Indians, or less? Why?
2. It is suggested that teachers use this section to focus on a special topic of interest: **Forms of Exchange Among Different Communities.**

Ask students to list the different forms of exchange that they can identify in the text — money, shell money (for equivalent pigs, etc.), barter, credit (bank in Honiara).

Both shell money and European money have similarities in that they are mediums of exchange, and can be used to pay for goods or services and used to buy different goods and services. Suggest advantages shell money and European money have over bartering. Suggest disadvantages. In what situations have you yourself used bartering? When have you used money? What has been different about these two situations?

Shell money and European money are both made from elements of the natural environment which have been altered in specific ways. European money in present days is usually made in a mint, each coin has a certain size, is made of a particular metal, combination of metals or printed on paper, and has a particular value associated with it. Throughout the society the value is recognised for the purchase of different goods and services.

Equally, shell money is made in a 'factory', the raw material (particular different types of shells) are changed in particular ways, and particular values are associated with different types of shell money. Dolphin teeth also have a value as a form of exchange. The more that is done to the shell money, the higher its value.

- If shell money traditionally had the same uses as European money, why do you think that European money has become important in Solomon Islands, and shell money used now mainly for ceremonial purposes? (Seeds are used only in the area of Langa Langa Lagoon for direct purchases from the shops, not all over Solomon Islands.).
- Why do you think tourists visiting Busu village might be willing to pay more than the local people to purchase strings of shell money? If a tourist sold his shell money in Australia, for example, do you think he would be able to sell it for more than he bought it? Why/Why not? (They no longer function as a means of exchange. Compare old coins from other societies — they have lost their original function and become museum pieces. You could also look at the relative value of two different currencies.)
- What is the role of exchange? Is it more than just buying goods and services? e.g. (a) Takwa

market — exchanging news as well as goods and so it has a social function. (b) Bride price —the bride's family provides food to about the same value as the shell money. The exchange is a part of traditional obligations and establishes relationships between the two families.

2.0 Fishing in Industrialised Societies

2.1 The Japanese Tuna Fleet

- 2.1.1 Tuna Hunt — the World's Biggest Oceanic Fishery
- 2.1.2 Ancient Tuna Fishing
- 2.1.3 Today's Tuna Fishery
- 2.1.4 The Keifuku Maru
- 2.1.5 The Future

This section looks at the Japanese tuna fleet and distant-water, deep-ocean fishing. It also looks at some of the Japanese competitors in the Pacific, the American and Australian tuna fleets. Each of these fleets is organised on the basis of advanced technology and commerical marketing.

Focus: Concepts of
- **Technology**
- **Fishing as an Industry**
- **International Competition**
- **The Relationship Between Industrial/Fishing Priorities and National Diet**

Student Activity

1. Study the impact of foreign fleets on local communities.

   Many of the Japanese distant-water fishing fleets are away from Japan for up to ten months at a time. During this time, they may occasionally come into foreign ports. Foreign ports function for the fleets as:

   supply bases
   emergency medical centres
   rest and recreation centres for crew

   Hobart, the capital of the Australian State of Tasmania, is one port which hosts Japanese fleets during the Tasmanian tuna season between approximately December and March.

   Suggest to students that they have been appointed a committee by the local council to look at the present and possible future impact on the city of expected continued visits by foreign fleets. They are to make a report back to the council on:

   - impact on local economy of the visits of the fleets
   - impact on local community of the visits of the fleets
   - action the council might take to improve facilities offered to the fleet, and to benefit the local community

   Students should look at economic impacts such as recreational facilities, eating, interpreter services, tourist shops, medical facilities. Social and community impacts could include members of the local community becoming more familiar with people of other cultures — and the culture of Japan in particular. Tensions could arise through perceived competition from local fishermen, because the visitors do not speak English. Joint ventures and enterprises might be stimulated between Australians and Japanese through contacts established through the fleets' visits.
2. Teachers may wish to do extension work in this area by taking up the issues raised in Book 3 *Using the Sea Wisely*. Section 4.1 of Book 3 is a case study of fishery management which looks at the state of the southern bluefin tuna population and attempts by Australia and Japan to come to some agreement as to the management of this fishery — a fair and reasonable allocation of resources among interested countries that will ensure the proper conservation of the species.

2.2 Australian Prawning

- 2.2.1 The Burts of Maclean
- 2.2.2 Catching King Prawns on the Silver Moon
- 2.2.3 The Clarence River Fishermen's Co-operative

This section looks at prawn fishing on the North-Eastern coast of the Australian state of New South Wales. It is an example of
(a) **local coastal fishing** and
(b) an economic activity which is often organised around the family.

This section also looks at the practice of **fishermen's co-operatives** — in this case the Clarence River Fishermen's Co-operative.

Focus: Concepts of
- **Family-based Business**
- **Co-operative Enterprise**

Student Activity

1. Introduce discussion on **the family as an economic unit**. Ask students to try to think of other examples where all or several members of the family share in bringing income into the family from the same source — e.g. farming. Students may be able to nominate small local businesses run by families — transport operators, animal breeders, etc. Why do some businesses, for example banks, not lend themselves to family participation?
   - What is the role of **women** in fishing families? How often do women work as deck-hands with their husbands? Why do they tend to work more often in fish processing factories?
   - What are the **economic stresses** on a family such as the Macleans? (Emphasise the fact of high mortgages and overheads and the capital investment involved in fishing of this kind.)
2. Would it be possible to catch large quantities of prawns by traditional methods? Is prawn-fishing necessarily a high-technology operation?

Make sure that students have a clear idea of how a fishing co-operative works.

- Ask them to speculate on the advantages and disadvantages of co-operatives, taking into account economic, ecological and social factors.
- In what other areas of work can co-operatives be established?

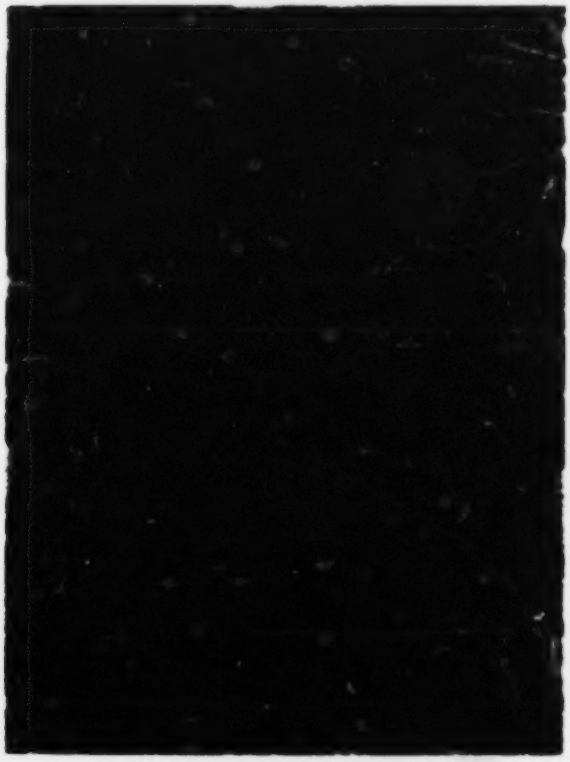
2.3 Salmon Fishing in Oregon, U.S.A.

This section looks at salmon fishing in the state of Oregon in the USA. It considers, briefly, the historical development of a fishing industry over a period of years and the transition from a subsistence fishery to a commerical and industrialised one.

Focus: Concepts of
- **— Historical Change**
- **— Commercialism**
- **— Industrialisation**

Student Activity

Initiate discussion in the area of historical change and the effects of industrialisation.
How were the fish affected?
How were the indigenous peoples affected?
What was the effect on population growth?
What were the effects on the composition of the local society?
What were the effects of industrialisation on health of the gill-netting fishermen?
What new conflicts take place when social and economic change occurs?
What new laws and forms of regulation become necessary when social and economic change occurs?



Part II Bringing the Catch to the Table

The focus in Part II is on what happens **after the fish are caught**. Section 1.0 looks at marketing and processing. Section 2.0 at the social, cultural and moral issues involved in the consumption of fish.

1.0 Fresh or Frozen?

1.1 The Fish Market

This section emphasises the importance of **freshness** and explains the **chemical processes** that take place after a fish is dead and why fish need to be preserved.

1.2 Ways of Preserving Fish
- 1.2.1 Chilling and Freezing Fish
- 1.2.2 Salting
- 1.2.3 Drying
- 1.2.4 Smoking
- 1.2.5 Pickling
- 1.2.6 Canning

1.2 looks at **methods of preserving fish** and the **nutritional value of processed fish.**

Focus: General Survey Skills
Practical Food Skills

Student Activity

1. In other parts of Book 2 there are references to ways of organising fish marketing. Ask students to draw diagrams of the different steps involved, from the fisherman to the customer, in the following markets.
   the Lau people of the Solomon Islands
   Japanese tuna fishing
   prawing off the coast of New South Wales
   Students may also undertake a research project into fish marketing in the local community.
2. Students could visit their local shops and make a study of what types of processed fish are available.
3. Where possible, co-operate with the other subject departments in the school
   (a) to conduct exercises in fish preservation e.g. salting, smoking, drying or home bottling (same process as canning-sterilisation by heat), and
   (b) to prepare recipes of sea-foods that students are unfamiliar with, e.g. squid.
4. You may also like to arrange a visit to a local Japanese restaurant to observe the preparation of raw fish.

2.0 Nutrition and the Ocean

2.1 Global Malnutrition — The Problem That Won't Go Away
2.2 Waste Not — Want Not
2.3 Food — A Reflection of Changing Attitudes
2.4 The Effect of Changing Diet: Tonga — A Case Study

These sections look at the social and moral issues relating to the human consumption of fish.

- How important are fish as a source of food?
- Are they distributed where they are most needed?
- What is the morality of using valuable fish protein in pet food when thousands of people in the world are starving?
- How rational are we in the kinds of seafood we choose to eat?
- What is 'consumer resistance'? How do our attitudes to eating fish change over time?

Focus: Value Judgements
Research and Inquiry Skills
Analysis of Comparative Data

Student Activity

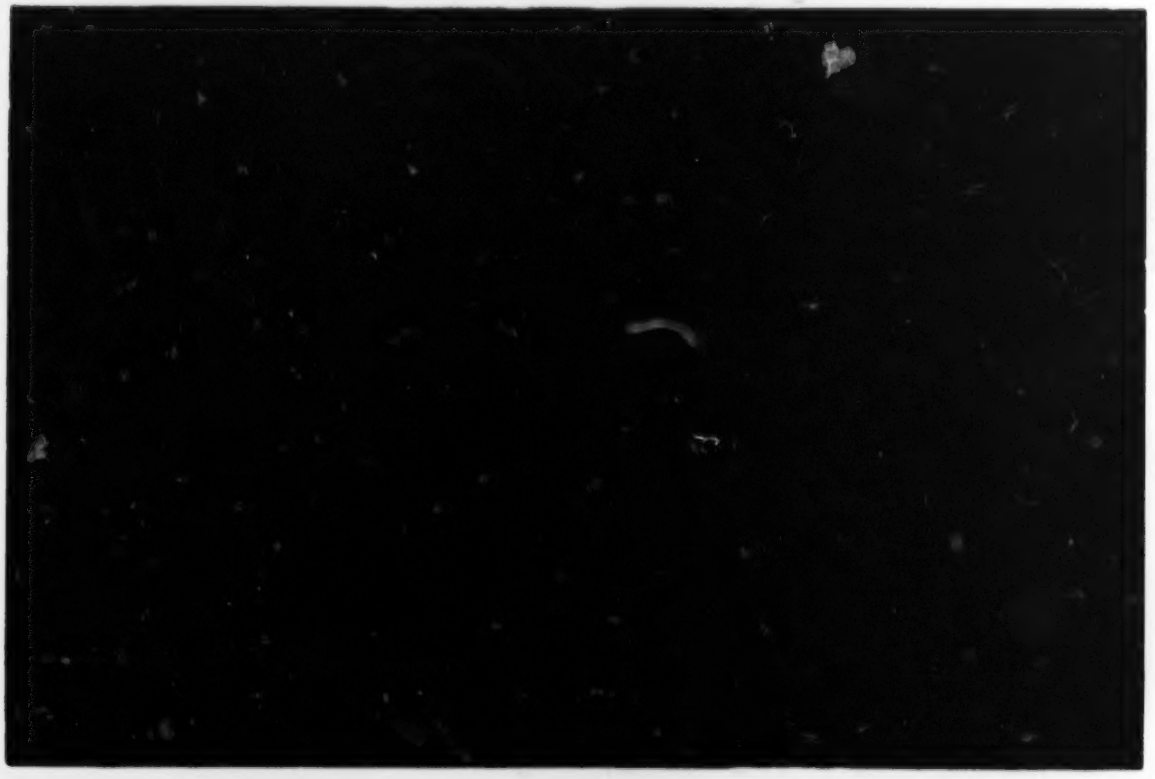
1. Section 2.0 is an obvious area for **student research and survey** into **patterns of food consumption.** Students can begin by researching patterns of seafood consumption and preferences/aversions within their own families.

   Teachers and students should devise, together, a survey sheet designed to elicit the desired information.

   Results can be collated in the classroom. Each student can then be given a written assignment on the interpretation of survey findings.

   Students may wish to extend their survey to interviewing local marketers of fish — fish shops, fishing boats that sell direct to the public, supermarkets, etc. Restaurants can be surveyed for their most popular dishes.

2. After individual assignments have been completed and handed in, students can discuss their findings in terms of the several local and national determining factors:
   - availability of sea-food, locally and nationally
   - types of processing carried out locally and nationally
   - amount and type of seafood imported/exported
   - import quotas and restrictions
   - historical influences; habit and custom
   - economic factors; government subsidies to certain types of fishing
   - changing patterns of scarcity and the effect on prices
   - family income: Do we eat what we can afford rather than what we prefer?
   - cultural/domestic factors; traditional cooking methods — Do they favour the use of certain kinds of seafood?
   - social factors: Do more women have jobs today? Does that mean an increasing preference for processed and pre-packaged 'convenience' food?
   - age factors: Do preferences for types of fish vary with age? An example is the fact that children tend to prefer bland seafoods such as fish fingers.



Book 3 Using the Sea Wisely

Book 3 is designed for upper secondary students and introduces a number of complex concepts to do with management and regulation of the ocean and its resources.

1.0 Using the Sea Wisely

1.1 The Sea — the Answer to the Earth's Food Problem?

Section 1.0 looks at the issue in broad terms and raises the question of the world's food problem and the present and potential resources of the ocean. It makes the point that the **focus** of Book 3 is on value-laden issues.

The important questions raised by Book 3 are:

environmental — How can the riches of the sea be utilised without destroying the natural environment of the ocean?

political — Who is entitled to this vast wealth?

economic — The advanced technology needed to develop ocean resources is expensive to build and sometimes to operate — this makes the product expensive to sell. How can we develop efficient, low-cost technology?

These are the questions that are explored in Book 3. Unlike the issues highlighted in Book 2 —which were largely issues of adaptation to the environment and fishing and knowhow — Book 3 is primarily concerned with **values**. Different cultures often have different values. How then do we arrive at some commonly agreed upon set of guidelines? Is it possible to agree on a 'common good'? To draw up a body of rules and stick to them?

2.0 A New World Order: The Law of the Sea

2.1 The Freedom of the Seas
2.2 The United Nations and the Law of the Sea Conference
2.3 The High Seas and the Common Heritage of Mankind
2.4 Environmental Protection and Conservation
2.5 Case Study: The Regulation of Whaling

Section 2.0 gives a very basic introduction to some concepts of International Law as they relate to the Law of the Sea. It looks at the work of the United Nations Law of the Sea Conference, with particular reference to UNCLOS III.

It examines what is meant by the 'High Seas', 'Territorial Waters', 'Inland Waters', treaties, conventions and international commissions.

Section 2.0 concludes with a case study of international regulation, the International Whaling Commission.

Focus: This is a very abstract section and students can best acquire a grasp of the principles involved through classroom simulation and role-playing

Student Activity

1. Allocate research projects into the development of conventions governing the evolution of the Law of the Sea. What were some of the landmark treaties, declarations, etc.?
2. UNCLOS III is still in session at the time of writing these materials. Suggest to students that they write to their Federal member of the House of Representatives, Senator or local Congressman to ask for up-to-date information on the UNCLOS III developments.

To conclude this section, set up a role play in your classroom.

Simulation Game

Food from the Ocean — A Forum

The United Nations is about to vote on a 'Law of the Fishers'. The bill sets out to control the collection and distribution of the ocean's food resources. The main ideas of the bill are as follows:

The Third World, the Soviet bloc, and the majority of America's allies, including Australia, have agreed that fish resources beyond the 200 nautical mile exclusive economic zones adjacent to coastal nations are 'the common heritage of mankind'. That is, no single nation or company can fish these areas without the approval of the international community.

It has been decided that an International Authority should be established on one of the South Pacific Islands. It has also been decided that a division of the authority, known as the Fisheries Enterprise, should be funded by a levy on all UN members, should engage in fishing on behalf of those countries that lack the funds or the expertise to launch their own fishing expeditions; and that half of all of the fish caught should be earmarked for the Fisheries Enterprise. Further, private companies applying for fishing rights will be required to sell their technology to the Fisheries Enterprise and will be required to abide by rules about size of catch, methods of catch, etc. These companies will have to pay royalties for distribution among the poorer nations.

Ask students to select one member of the class to be your country's representative at the UN. Other members of the class should select a role to play from those listed below:

1. **A business executive** from a large internationally based fishing company. Your company is involved with fishing the world over. It provides fish for human consumption as well as for pet food and fertiliser.

2. **A spokesperson for a 'Food for People — not Profit' organisation.** You are opposed to food being used as a capitalistic commodity.
3. **A conservationist** who is concerned about the ecological balance in the world's oceans and considers that major fishing ventures must be carefully monitored and controlled.
4. **A nutritionist** who is concerned about global food supplies — particularly protein deficiencies in third world countries.
5. **A lawyer** who is concerned about the legal implications of trying to enforce the 'Law of the Sea' in international courts.

Students can role play a public meeting called to consider how their representative should vote at the UN meeting. After a presentation has been made by each of the forum members, the UN representative should come to a decision and report back to the constituency.

3.0 Protecting the Ocean Environment: Pollution Control

3.1 Oil Spills
3.2 Chemical waste
3.3 The Battle for the Shorelines
3.4 A Success Story: the Kualu Jaru Co-operative

Section 3.0 looks at the main **sources** of ocean pollution and focuses on two in particular:

- oil spills
- chemical effluent from industry

It looks at the environmental and human damage caused by disasters such as the *Torrey Canyon* spill and the notorious *Minamata* disease.

A feature of this section is an account of the less well publicised damage being done to **shoreline and estuarine systems** and the importance of these areas to the maintenance of sea life.

Section 3.0 ends on a positive note with a look at the Kualu Jaru Co-operative in Malaysia where the local inhabitants respond to the effect of pollution by creating a whole new aquaculture fishery and administering it through a co-operative.

Focus: Research Into Contemporary Documents
Excursion Work
Planning Exercises/Devising Models

Student Activity

1. Organise student research into local environmental legislation.
   - Does it exist?
   - Does it protect foreshores?
   - What are the most common violations?
   - What is the rate of persecution in the courts?
   - Are the penalties appropriate?

   Invite a spokesperson from the Environment Department or its equivalent to address students on these and related matters.
2. Where possible, organise an excursion to the nearest mangrove or foreshore area. Students can survey the amount and type of pollution in the area.
   - Is there farmland adjacent? What kind of pollution is likely to flow from this?
   - What is the extent and nature of manufacturing industry nearby?
   - What kinds of effluent are discharged by this industry?
   - How much dumping of rubbish by ordinary citizens is taking place? How many different items of rubbish can be identified (abandoned cars, soft-drink cans, plastic bags, etc.)?
   - What is the local authority responsible?
   - Are there any signs prohibiting dumping or warning of polluted water? If signs are present, are they adequate?
   - What is the attitude of residents in the area?
3. Refer students to Section 2.2 of Book 2 of *Harvesting The Ocean, The Harvest*. This section highlights the functioning of the Clarence River Fishermen's Co-operative in New South Wales. Ask students what differences and similarities they would expect to find between the Clarence River and Kuala Juru Co-operatives?

   Ask students to discuss drawing up a management plan for the Kuala Jaru Co-operative. Given their limited knowledge of the area and taking into account their perspective as outsiders, what would they assume would be the major
   — economic problems? (financing, marketing, etc.)
   — management problems?
   — environmental problems?
   — social problems?

   Would such a co-operative work in the student's own area?

4.0 Fisheries Management

Section 4.0 begins by looking at the concept of a **resource** and of the **conservation of resources**, with special reference to fish. It then asks the question: What do we mean when we talk about 'management'? Following on from this it sets out a very simple model of a management plan in 8 steps — a plan which students can apply to any local fishery, or other problem for that matter, in later exercises.

4.1 Case Study: State of the Southern Bluefin Population
- **4.1.1 The History of the Fishery**
- **4.1.2 The State of the Population**
- **4.1.3 Developing a Management Plan for the Fishery**

Section 4.1 on the management of tuna fishing, gives a practical application of the concepts introduced in earlier sections. It shows

(a) the **ecological** factors that have to be taken into account in managing a fishery,
(b) the necessity for **controls**, voluntary or imposed,

(c) the **types of controls** appropriate to a particular fishery,
(d) the ways in which **controls affect catches**, both from the point of view of the survival of the fish and the profit-levels of the fisherman, and
(e) the ways in which **nations compete** with one another for resources.

4.2 Ecosystem Management
4.2.1 A New Resource — Krill
4.2.2 Developing a Plan for the Wise Use of Krill

Section 4.2 focuses on the need to attend to conservation priorities in drawing up management plans for new **resources**, in this case **krill**.

4.3 Aquaculture — the Protein Producer of the Future?
4.3.1 Fin fish
4.3.2 Shellfish
4.3.3 Seaweed

This section on aquaculture is designed to give a basic introduction to the concept and practice of fish farming.

4.4 Finding Alternative Products
4.4.1 Jojoba — A Future Oil Crop?

Section 4.4 looks briefly at one of the management strategies that comes into account when conservation is an **urgent** priority — the development of alternative products. Here the focus is on alternatives to **whale** products and the potential uses of the **jojoba plant.**

Focus: Planning Models
Future Projections
Decision-making

Student Activity
Section 4.0 is, unavoidably, a fairly dry area of study and needs a lively classroom presentation. Group-work and problem-solving exercises are recommended.

1. Divide the class into 'national' groups — Japan, Australia, the United States, New Zealand. Have each group appoint a delegate to attend an international commission on tuna. Arrange delegates in a seating plan at the front or in the centre of the class so that they can 'publicly' negotiate a management plan for tuna fisheries — taking into account national interests, ecological factors and so on. Have delegates report back to their group for ratification of agreements or further instructions.
   Note: most of the day to day business of government, of economic and social administration, and of private industry is conducted in these or similar terms. A unit of study such as this, while not as dramatic or emotionally stirring as, say, a focus on whale conservation, if carefully structured in the classroom can give students a valuable insight into the workings of public policy. It can be a valuable part of their education in showing that such issues are highly complex — it will help to counter oversimplified and stereo-typed thinking in the future.
2. Have your students draw up a plan for the wise management of krill. You may like to give out copies of the question sheet that follows. Students can perform this exercise on the basis of group or collective decision-making, or on the basis of preparing individual assignments.

Drawing Up a Management Plan For the Use of Antarctic Krill.
In the light of the sorts of questions raised in this book, decide how you would go about drawing up a plan for the wise use of Antarctic krill.

Below are some questions to consider in working out your plan. Can you represent any of these in a diagram or graph? Add any questions you think relevant.

Ecosystem
What quantity of krill is there in the Southern Ocean?
How much krill can be harvested without damaging the ecosystem?

Interests of Different Groups of People
What would the krill be used for?
Who would use the krill?
How much krill would be used?
Are there groups who could be expected to oppose krill fishing? If so, who are they, and what would be the reasons for their opposition?

Environmental Changes
Are there environmental changes which might affect the krill fishery, e.g. oil spills?

Technology and the Needs of Business
What methods are there for harvesting krill?
What skills and equipment do people need?
How will the krill be processed to stop it deteriorating?
To make it palatable to eat?
How will the krill be distributed and sold to customers?

Regulation and Control
Krill are found in international waters off Antarctica.
Who is able to work out a plan for the wise use of krill in international waters?
What groups will be involved in the krill fishery?
What government regulations and laws need to be taken into account in any plan?
How can the plan be monitored?
How can the success of the plan be assessed and the need for changes judged?
How can any necessary changes to the plan be made?

3. **Aquaculture**
   The best way to study the subject is through student excursions to the site of a fish farm. For students in inland areas there are often freshwater fish-farms in local or adjacent areas.